

REMARKS

In the patent application, claims 1-21 are pending. In the office action, all pending claims are rejected.

Applicant has amended claims 1, 5, 12 and 17 to include the limitations that the substrate is substantially planar and that the substrate has a plurality of apertures made through the first and second surfaces of the substrate. Furthermore, each of the fuel activation assembly segments has a photon-exchange membrane sandwiched between two activation layers.

The support for the amendment can be found in Figures 2b, 3 and 4a where the substrate 140 is shown as being substantially planar and as having a plurality of apertures 142 made through the two opposing surfaces of the substrate 140, and the fuel activation assembly segment 110 has a photon-exchange membrane 120 sandwiched between two activation layers 112, 114 (page 6, lines 5-16).

No new matter has been introduced.

At Section 3 of the office action, claims 1-21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner states that the term "fuel" in claims 1-21 is used to mean a hydrogen fuel reactant (hydrogen comprising reactant) and an oxidant reactant.

It is respectfully submitted that claims 1-21 only contain the terms "fuel-cell", "first fuel component" and "second fuel component". As disclosed on page 1, lines 9 – 22, the fuel cell has an anode side and a cathode side. The first fuel component is a mixture of water and methanol provided in a first cell compartment in the anode side. The second fuel component is air provided in a second cell compartment on the cathode side. While the hydrogen atoms in the mixture of water and methanol can be separated by the catalytic activation at the membrane electrode assembly into protons and electrons, the mixture is not exactly a hydrogen comprising reactant. Furthermore, while the air on the cathode side is used to allow the protons migrated to the second cell compartment to combine with oxygen in the air to form water molecules, air is not usually called an oxidant reactant. The terms hydrogen reactant and oxygen reactant are

usually referred to as the hydrogen and oxygen in a hydrogen fuel cell where the oxidation of hydrogen turns the separate gases into water.

For the above reasons, applicant wishes to retain the terms “first fuel component” and “second fuel component” in the claims. Furthermore, the claims include the claim language that each membrane electrode assembly segment comprises a proton-exchange membrane sandwiched between two activation layers for activating the first fuel component in the first cell compartment in order to produce protons and to channel part of the protons to the second cell compartment through the membrane electrode assembly segments. Thus, the claim language is clear and definite to a person with ordinary skill in the art of fuel cell technology.

Withdrawal of the 112 rejection is respectfully requested.

At Section 4, claims 1, 5-15 are rejected under 35 U.S.C. 102(b) as being anticipated by *Koripella et al.* (U.S. Patent Number 6,465,119 B1, hereafter referred to as *Koripella*). The Examiner states that *Koripella* discloses a fuel cell as claimed. In particular, the Examiner considers the base portion 14, 14' of Figures 1 and 3 as being equivalent to the substrate (140 in Figures 2a and 2b) of the claimed invention.

It is respectfully submitted that, the amended claims 1, 5 and 12 have the limitations that the substrate is substantially planar and that the substrate has a plurality of apertures made through the first and second surfaces of the substrate.

Koripella only discloses a base portion to support two individual fuel cells. The base portion has an interconnecting manifold to supply a liquid fuel component to the individual fuel cells. *Koripella* does not disclose a substantially planar substrate having a plurality of apertures made through the first and second surfaces of the substrate.

For the above reasons, claims 1, 5 and 12 are clearly distinguishable over the cited *Koripella* reference.

As for claims 6-11 and 13-15, they are dependent from claims 1, 5 and 12 and recite features not recited in claims 1, 5 and 12. For reasons regarding claims 1, 5 and 12 above, claims 6-11 and 13-15 are also distinguishable over the cited *Koripella* reference.

At section 5, claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Koripella*, in view of JP 11-045729 (*JP '729*). The Examiner cites *JP '729* for disclosing a heat

bonding process wherein each of the cover sheets 1 has a hot melt layer to be bonded to a junction body 3 and possibly part of the porous electrode substrates 2. Thus, *JP '729* discloses a method of forming an electrolyte/electrode body comprising a sandwich of porous electrode/catalyst layer/porous electrode to be used as a solid polymer electrolytic cell. In contrast, the heat bonding process is used to attach each membrane electrode assembly segment to a substrate over an aperture for preventing the first fuel cell component from entering the second cell compartment and the second fuel cell component from entering the first cell compartment. *JP '729* does not disclose such a feature. Furthermore, claim 2 is dependent from claim 1 and recites features not recited in claim 1. For reasons regarding claim 1 above, claim 2 is also distinguishable over *Koripella* and *JP '729*.

At section 6, claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Koripella*, in view of *Morse et al.* (U. S. Patent No. 6,960,403 B2, hereafter referred to as *Morse*) or *Arroyo et al.* (U.S. Patent Application No. 2005/0019635 A1, hereafter referred to as *Arroyo*). The Examiner cites *Morse* and *Arroyo* for disclosing using an adhesive for sealing.

It is respectfully submitted that *Morse* discloses a microfluidic fuel cell system having a single electrolyte layer 104 disposed between an anode 104 and a cathode 110 (see Figure 1; col.3, lines 42-54). The fuel cell system has a manifold system (112, 114) to provide liquid fuel through a plurality of apertures on the plate 112. *Arroyo* discloses a fuel cell having two substrates each having a plurality of holes, wherein a fuel cell assembly having an anode layer 4, a membrane layer 5 and a cathode 6 disposed on the walls of each hole. The objective of the invention in *Arroyo* is to provide a fuel cell system with a large activation surface in a reduced cell volume. Furthermore, claims 3 and 4 are dependent from claim 1 and recite features not recited in claim 1. For reasons regarding claim 1 above, claims 3 and 4 are also distinguishable over the cited *Koripella*, *Morse* and *Arroyo* references.

At section 7, claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Koripella*, in view of *Pratt et al.* (U. S. Patent No. 6,127,058 B2, hereafter referred to as *Pratt*) or DE 19624887 (*DE '887*). The Examiner cites *Pratt* and *DE '887* for disclosing connecting the fuel cells in parallel and in series.

It is respectfully submitted that *Pratt* discloses a planar fuel cell have a single PEM or electrolyte sheet 23 and a plurality of anodes 27 and cathodes 28 arranged in pairs and separately disposed on opposite sides of the PEM (col.3, lines 62-67). Furthermore, claim 16 is dependent from claim 15 and recites features not recited in claim 15. For reasons regarding claim 15 above, claim 16 is also distinguishable over the cited *Koripella*, *Pratt* and *DE '887* references.

At section 8, claims 17-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Koripella* over *Mardilovich et al.* (U.S. Patent Number 7,033,691 B2, hereafter referred to as *Mardilovich*). The Examiner cites *Mardilovich* for disclosing a portable computer or PDA.

It is respectfully submitted that *Mardilovich* discloses a micro-electro mechanical structure (MEMS) based fuel cell having a substrate 50 to support an electrolyte layer 40 sandwiched between two electrode layers. The substrate 50 has an opening 60 with an extended opening portion 65 to relieve mechanical stress of the fuel cell structure. Thus, *Mardilovich* is irrelevant to the present invention.

Furthermore, claim 17, as amended, has the limitations that the substrate is substantially planar and that the substrate has a plurality of apertures made through the first and second surfaces of the substrate. *Koripella* only discloses a base portion to support two individual fuel cells. The base portion has an interconnecting manifold to supply a liquid fuel component to the individual fuel cells. *Koripella* does not disclose a substantially planar substrate having a plurality of apertures made through the first and second surfaces of the substrate. *Mardilovich* does not disclose a substrate having a plurality of apertures and each aperture is covered by a membrane electrode assembly segment which is securely attached to the substrate.

For the above reasons, claim 17 is clearly distinguishable over the cited *Koripella* over *Mardilovich* references.

As for claims 18-21, they are dependent from claim 17 and recite features not recited in claim 17. For reasons regarding claim 17 above, claims 18-21 are also distinguishable over the cited *Koripella* over *Mardilovich* references.

CONCLUSION

Claims 1-21 are allowable. Early allowance of claims 1-21 is earnestly solicited.

Respectfully submitted,



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